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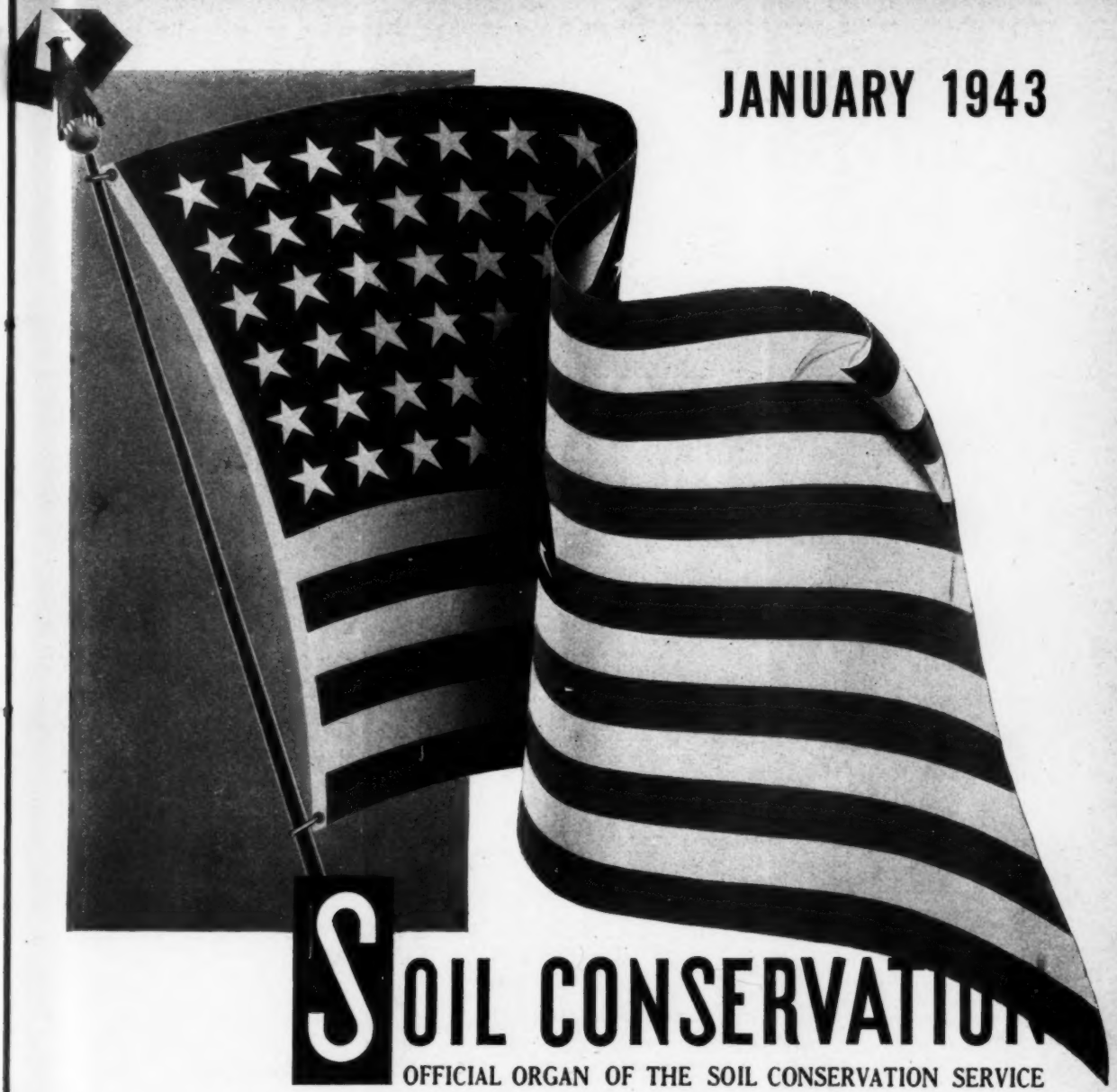

JANUARY 1943

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

Conservation goes to war! Sod for drill fields! Legume seed for the South! New production methods for China! These and other vital developments are told in this issue. C. R. Enlow tops it off with a pointed discussion on Production Through Conservation.

UNITED STATES DEPARTMENT OF AGRICULTURE – WASHINGTON

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WELLINGTON BRINK
EDITOR

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SOIL CONSERVATION

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SOD GOES TO WAR

BY J. M. SLOAN[1]

THIRTY THOUSAND Navy recruits needed mud-free drill grounds to train for the grim business of war. That is why the Navy Department turned to the Soil Conservation Service for sod—miles of it—when construction was started on a 50-million dollar training base near Sampson, N. Y. Sod, the Navy said, was preferred to seeding or paving because it afforded the cheapest and quickest way to provide usable drill fields with minimum demand on critical materials and construction equipment.

Some 17 miles from the training station is the 13,000-acre Hector Land Utilization project, which sprawls over Seneca and Schuyler Counties. Here was sod, and plenty of it. Could the Navy have about 200 acres of sod? Yes, the Navy could; and thus, almost in less time than it takes to tell it, arrangements were made for one of the largest sod-removal operations on record.

The Service, of course, specified places from which sod could be removed—only level, unimproved portions of the project area could be used. The Navy agreed to lime, fertilize, and seed after sod was removed.

On July 11 contractors for the Navy Department started cultivating the sod sites selected by the Service. The areas were mowed and raked twice. A 10–5–10 fertilizer was applied, and some of the fescues, with Canada bluegrass, Kentucky bluegrass, orchard grass, and red top, were sown. A heavy farm roller was then used to compact the sod.

The contractors employed mass production methods when the sod was ready for cutting, lifting, and laying on the drill fields. This work started September 5 with more than 150 laborers, several standard sod cutters and between 30 and 40 trucks in action. The operation was on such a large scale that contractors erected "Navy Sod Farm" signs throughout the project area.

This is how they operated: After the sod cutters had passed, crews cut the strips into 2-foot lengths. Other crews, working in teams and using pitchforks, then lifted the blocks of sod to wooden trays, 4 to a tray—6,000 trays were required to maintain the pace. The trays were then stacked and loaded on flat-bed trucks, 60 to 70 making a load. Each truck made about 4 round-trips between the sod farm and the training station in 12 hours.

One of the Navy sod-farm signs.

At the drill fields, where the ground had been prepared by disking, raking, and fertilizing, as well as mixing peat and sharp sand with the native clay, the trays were lifted from the trucks by hand. The four blocks of sod were slipped off by tilting each tray. Sod placers seldom had to move the blocks more than a few inches to get them in place. After a considerable area of sod had been placed, a top dressing of soil was applied and dragged with a light drag to fill in cracks and depressions. More seed and fertilizer were then applied.

By November 15 the contractors had completed the laying of 3,600,000 square feet of sod. The average per day was 51,500 square feet, and the maximum laid on any one day was 112,000 square feet.

[1] Chief, regional land management division, Northeast Region, Soil Conservation Service, Upper Darby, Pa.

Thus, sodding of the drill fields was practically completed in a little more than 2 months. The fields are ready for the marching feet of the 30,000 recruits who are pouring in for training. Sodding of other sections of the station will be resumed in the spring.

Aside from the sod that went to war, the Hector project has been doing its bit in another way. More than 2,700 head of livestock owned by neighboring farmers grazed the 5,200 acres of improved and managed pastures during the season just past. Another crop that will do its bit is the 3,900-acre forest plantation in the project area—this forest will replace some of the timber now being harvested for war. Still another contribution of the multiple-use Hector project is the recreation area and picnic grounds, where people of the community can enjoy those days in the open that are so important to a people at war.

Cutting the sod in strips.

PRODUCTION THROUGH CONSERVATION

By C. R. ENLOW [1]

WITH customary American impatience, many sincere, optimistic individuals are seeking methods whereby conservation practices that will increase crop production may be applied overnight to the farm lands of the country. Their efforts are to be commended; but it seems advisable to point out a few dangers that lie ahead, not with the idea of discouraging such worth-while efforts, but in hope some pitfalls may be avoided.

ANYONE working in soil conservation for the past few years must appreciate that the control of erosion is a tough, long-time job. It is impossible to control it without getting at the source of erosion, which goes back to land use. If it isn't a tough job, why have we succeeded in developing erosion control treatment for only 130,000 farms since 1933?

RECENT instructions have gone out from Washington, urging Soil Conservation Service personnel to take a very active part in assisting with the widespread application of conservation practices, because it has been proved beyond a doubt that conservation practices do increase production. The production goals must be met, and if we have information that will help increase production, and do not make our contribution, we deserve severe criticism. In other words, we must take on two jobs: We must continue our present efforts to make a sound approach toward securing conservation on as many farms as possible, and in addition, try to get the widespread use of practices that will increase production to meet the present urgent demand for more food. In the latter, it is rather comforting to know that the men who are working directly with farmers are trying to warn Washington that such a procedure is dangerous. It is also

[1] Chief, agronomy division, Soil Conservation Service, Washington, D. C.

dangerous to face the Japs and Huns on the firing line. But we must do our job, and it is gratifying to realize that the dangers are recognized. We are relying on the intelligence of experienced personnel to avoid all possible dangers and yet help accomplish the immediate objective—to win the war.

IN this country, we find an endless combination of factors that are responsible for erosion: those beyond the control of man, i. e., rainfall, soil variation, and topography of the land; and those under man's control, as tillage practices and the many phases of crop and livestock production. There are endless combinations and variations of the factors, all of which are reflected in varying methods of erosion control. Control measures in erosion depend entirely on local conditions and problems, hence, become rather definitely a local proposition. It is only the principles of erosion control that can be approached from a national basis.

ASSUMING for the moment that it is possible to pass over the diagnosis of the farm—in order to arrive at proper land use and to develop a water disposal system for the farm—let's see what we might accomplish by recommending one "single" practice to be applied, nation-wide, to farms and fields as they exist at present. Contour farming—plowing, planting, and cultivating on the contour—is regarded by most everyone as relatively simple. It is not difficult to run contour lines, after a few minutes' instruction, and operating machinery on the contour involves no difficulties unless the land is particularly steep in which case it probably shouldn't be cultivated at all.

REPORTS have come in from all over the country citing increased yields of crops from contour planting—wheat from the Great Plains, corn in the Corn Belt, beans in the Southwest—practically everywhere yields of crops have gone up as a result of the practice. On the basis of these reports, why not go all-out for contour farming? If it will conserve soil and increase crop yields, what more can we ask? Suppose we look about the country just a bit to check on the facts concerning contour farming.

IN the Southeastern States, contour farming is a rather general practice, and in many localities it is the exception to find a field with rows of cotton or corn running up and down the slope. But one thing becomes evident almost immediately—one seldom sees contour planting *except on terraced land*. An occasional small field, or narrow field, may be observed that is contoured, without terraces, but any appreciable acreage so treated is not evident.

IN the Northeastern States, contour farming has spread rapidly in recent years. Here we observe a rather limited acreage under terraces, but with the contouring we find extensive strip cropping. Farmers were growing crops in strips, on the approximate contour, in West Virginia, New York, Wisconsin, Pennsylvania, and other States many years ago. But an entire field, planted on the contour to one crop was seldom seen, nor is it to be seen now.

VERY little contour planting was done in the Corn Belt previous to the present conservation program, and the present contour planting is nearly all associated with strip cropping or terracing. In the Far West, considerable "across the slope" farming is found on steep slopes, as in the Palouse country and the California hills, largely because it is impossible to operate machinery up and down the hills. Farmers there are much interested in "mulch" farming—keeping the crop residue on the surface to help prevent soil washing during the fallow season. In the Great Plains contouring has been quite successful, but farmers are intensely interested in mulch farming, and in wind erosion areas strip cropping occurs extensively. In other words, there are no extensive areas in the country where contour tillage is used alone. Why?

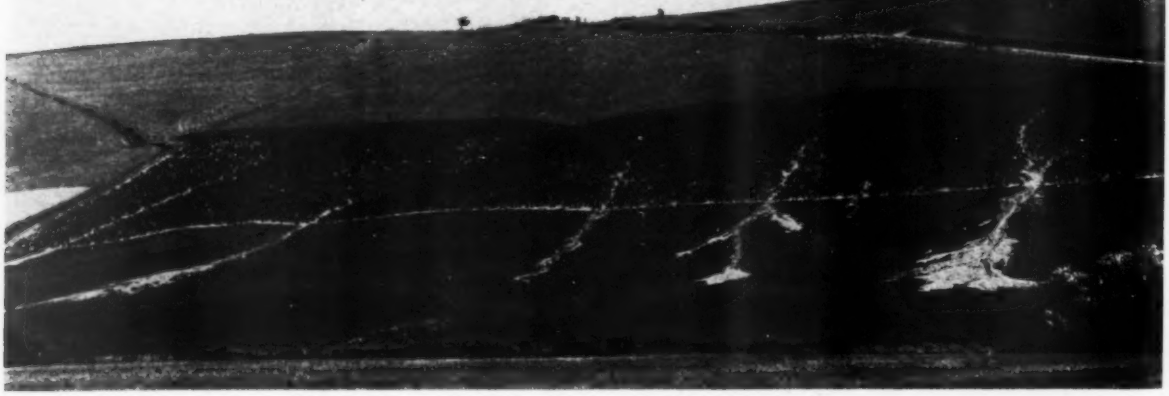
SEVERAL years ago, I was on a farm in the loessial soil area of eastern Nebraska with J. N. Lowe, who was at that time Acting Regional Agronomist at Salina, Kans. We had been arguing about contour farming, and Lowe took me to the farm to settle the argument. It did. The farmer had been growing corn up and down the hill, and Soil Conservation Service employees had convinced him he should put his rows across the slope, to prevent soil loss. Gullies several inches deep were formed between the corn rows each year, and the farmer realized he was losing soil. So he agreed to try contouring, and planted across the slope, as nearly on the contour as possible. The result was the elimination of small gullies—but instead 8 or 10 large ones, waist deep, were evident. Water had followed the contour rows to the first depression, had broken over, accumulated in ever-increasing amount as it received the contribution of water from each contour furrow it passed, until it became a raging torrent, carrying tons and tons of soil directly down the slope.

CONTOUR tillage, as a *single* practice, might have been all right, if we had started using it when the sod was first broken years ago. But on most fields today, there is a definite erosion pattern already established—many depressions that make it impossible to work on the exact contour with machinery and prevent water accumulating and breaking down the slopes. Sod strips as in strip cropping, terraces, or something to prevent the continued accumulation of water is necessary if contouring is to be successful. Otherwise serious and irreparable damage to the land is almost certain to result.

AND so it goes. There is no "simple" practice or "single" practice that is safe to recommend without qualification. Terracing must have its protected outlets and supporting agronomic practices; cover crops must be considered from the standpoint of

(*Continued on page 156*)

This picture illustrates how water concentrates in depressions where rows of potatoes cannot be kept on exact contour. Result, the beginning of serious gullies.



NOW CHINA PREPARES FOR INCREASED PRODUCTION THROUGH SOIL CONSERVATION

BY W. C. LOWDERMILK[1]

I

IT is with deep satisfaction that I leave again for China—this time to help that great people set up a Soil Conservation Service, to bring to the most populous nation of the earth the benefit of our experience in applying measures of soil conservation to the land under the inspiring leadership of Hugh Bennett. The Chinese have established the most enduring civilization of the earth, a civilization which merits our study as we work out ways and means to adapt and apply the secrets of longevity to our own social structure. Thus while we shall have certain technical contributions to make to China, we shall also have much to learn from this so great a people.

The fact that we are able at this time to contribute our movement for soil conservation to other countries is remarkable. It is a fine new thing—a hope of the future—that out of a philosophy of inexhaustible resources we should have developed a philosophy of conservation within so brief a space of time. It is the prophetic spirit that abides in a healthy social organism, and it is this foresight that may be imparted to other countries and must needs be adopted by peoples of the world after the bloody business of this war is over, if we are to do any better than we have done up to this date after 7,000 years of civilization.

Land is the common denominator in international relations. When our dealings between nations are put in terms of the land as a means of production, as of greater importance than the products that have been separated from the land, then we shall get down to bedrock in working out the reconstruction of the world, in the interest of the common

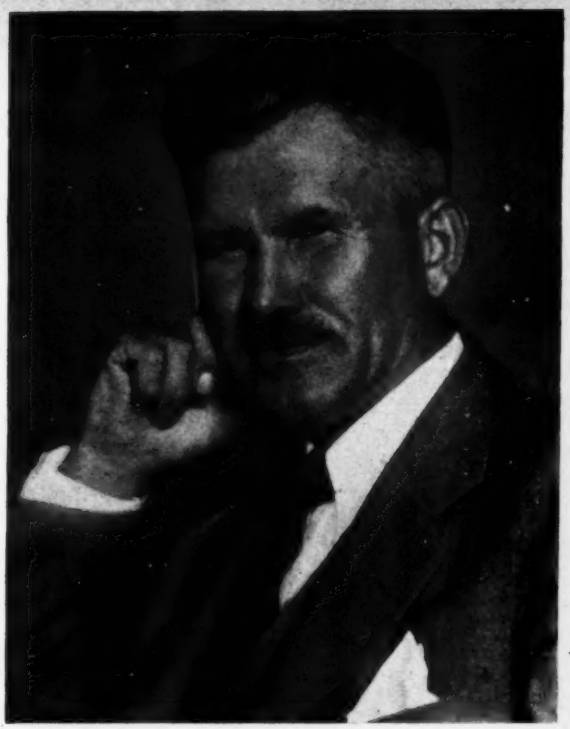
[1] Assistant Chief, Soil Conservation Service, Washington, D. C.

man and of mankind. Besides, the land is seen and felt. What we do with the land is plain to see and to read—a farmer, a nation, a civilization, writes a record indelibly upon the land. Measures of conservation worked into the land are understood by all; their significance may be perceived by the wise and the foolish. How much more significant are these works than words, generalities, however plausible. Work on the land has a meaning beyond the next harvest, beyond the farm boundary. It shows forth the intentions of a people. We, as a people, express our will to live through our treatment of the land as surely as we fight on the battlefield.

Back to China where the everlasting significance of soil erosion was burned into my consciousness . . . It was while making agricultural explorations in the vast loessial region of northern China that I was made to realize that soil erosion will undermine a civilization and is more effective than adverse change of climate in reducing the carrying capacity of land for a people and its civilization. Mere descriptions with speculative conclusions were not enough; I knew that we must measure effects of erosion to know what is going on within a nation and to judge how great a menace it is to sustained use of the land. This I did in China, as was reported in 1924, 1925, and 1926.

II

HUGH BENNETT and I came to this problem of erosion from different directions. He, our Chief, descended from a long line of able farmers, took up the science and practice of soil surveys nearly 40 years ago. He early showed a remarkable ability to perceive the operation of natural forces, to draw conclusions from his field observations, even though these conclusions were at variance with the accepted opinions of the times. He lived so closely with the fields and woods that he discovered that conditions on the land were not static, but were changing and, more, that single cropping, plowing up and down slopes, and other abusive farm practices were setting in motion the forces of soil erosion which were changing the face of the landscape and undermining the very base of a lasting and prosperous agriculture. Even more, he saw that these wasteful practices were undermining the basis of a civilization in this new land where it was the style to consider natural resources as limitless and inexhaustible. It was a trait of genius that led Hugh Bennett to discover and proclaim the warning of a deadly menace in the midst of our self-complacency and unbounded optimism. This partakes of the prophetic element in a healthy society.



Dr. Walter C. Lowdermilk.

EDITOR'S NOTE.—*An unusually able American, Dr. W. C. Lowdermilk, has spent his lifetime as a citizen and scientist of the world. Today, as a representative of the United States, he is in China—a land that respects learning above nearly all else.*

Dr. Lowdermilk's latest assignment is to help produce more food for fighting millions and to help make secure the soils of an old but constantly living China.

Dr. Lowdermilk knows the lands and the people of China. He knows also the lands and the people of the United States, of Europe, of North Africa, of Egypt, of the near East. He knows languages. He knows how to work with his hands. Most important, he knows the uses of science, patience, and planning. Patience and planning in the present Chinese situation must, in turn, entail courage and vision—and Dr. Lowdermilk's record reflects both of these qualities in generous measure.

In spite of ridicule—some said he was a "half-baked enthusiast"—Hugh Bennett persisted and called for actual measurement of erosion. He had to wait many long years before this opportunity finally came, when a Congressman of Texas, James P. Buchanan, with a rare sense of foresight and

statesmanship, called for a congressional hearing on soil erosion in 1928, which gave rise to the first congressional appropriation for a study of soil erosion on our farm lands. Presenting his request for supporting funds in the form of an amendment to the Agricultural Appropriation Bill, Congressman Buchanan's proposal was accepted without a dissenting vote. Hugh Bennett, who had presented the technical evidence at this hearing, soon thereafter established 10 erosion stations in critical problem areas of the United States and began the measurement of waste of soil by accelerated erosion and loss of rain waters by surface runoff.

As for myself, I first came to a realization of the significance of erosion in 1914 as a forest ranger in Arizona where overgrazing of forest ranges was prevalent in my ranger district of Tonto National Forest. I had been trained as a geologist as well as forester, so the complaints of "old timers," the pioneer stockmen of Arizona, that the grass was no longer as high or as heavy as it was in the early days, and that the former small clear streams had become great wide stony and dry washes, made a great impression on me. Thus it was that we began field observations and a study of erosion as it was affected by the condition of the land.

By this time, other observers, especially among geologists, had reported their observations on erosion—Leonidas Glenn, Salisbury, Van Hise, Nathaniel Shaler. The subject was receiving academic interest, but nothing was being done about it. Importance of the problem was recognized where the observer had the faculty to perceive the long-range operation of natural processes, as of interest in forecasting what such a process at work in a landscape would accomplish in 10, 20, 50, or 100 years. Thus far, however, conclusions by such observers were speculative for they were not based on measurements. There was no mathematical way to forecast the end result of accelerated soil erosion.

Then after serving 2 years with the Engineers of the A. E. F. in World War I, I went to China in 1922 on a project of the University of Nanking for famine prevention. I made regional surveys or explorations in that part of China where the famine hazard is high—the area which had been ravaged only a short time before by the great famine of North China of 1920–21.

In the course of the first survey, we visited the site of the great break of the Yellow River dykes in 1852. As we traveled over the vast Yellow River Delta plain, in time we saw looming up out of the haze a long flat-topped hill from horizon to horizon. This peculiar flat hill seemed to grow in height as we approached nearer and nearer. Finally, we climbed up the slopes to the top, some 60 or 70 feet above the river plain. Our view was amazing. Here was another vast plain fully 50 feet above the one we had just left and 10 to 20 feet below the crest of our flat-topped hill that stretched in a straight line from horizon to horizon. This was the outer dyke of the Yellow River.

We traveled on over the uplifted plain toward the horizon at right angles to the dyke. In a distance of 8 miles we came to another dyke about 20 feet high. When we mounted it, lo! we looked upon the Yellow River, China's Sorrow, a broad stream of brown water marked by many shoals and sand bars. As the cold autumn wind tugged at our clothes, we contemplated this remarkable scene, for the Yellow River had been lifted up by these dykes 50 or 60 feet above its delta plain. As we pondered the astounding achievement, I was overwhelmed in trying to imagine how millions of Chinese farmers, without machines, with their bare hands almost, had kept the mighty Yellow River in its ever-rising bed for 600 years over a distance of 400 miles. What an amazing amount of work had gone into this gigantic task by nameless heroes of flood control!

But why should millions of farmers have to do all this? Silt, silt, silt! It was deposition of silt in the river channel that each year made the capacity of the channel less, so that the inner and outer dykes had to be raised a corresponding height to prevent overflow and break of the dykes during high water. Silt may be rock floor that is ground up by boulders and gravel in a stream channel under the action of flowing water, and silt may also be soil particles washed into a stream by soil erosion. Whence such silt as we saw in the waters of China's Sorrow?

Thereupon, it was my determination to find out where this silt came from that had been the occasion of so much human labor and sorrow and tears through the centuries.

The next field trip was made for this purpose in a joint exploration by O. J. Todd, Chief Engineer of the International Famine Relief Commission, and myself. We found in the Province of Shensi in the valley of the Wei River, the largest tributary of the Yellow River, evidences of an irrigation project that, according to record, was begun in 247 B. C. We examined the site of the intake of the original canal, but then the river was 60 feet below the intake—showing how the stream had excavated its channel in the past 2,000 years. From time to time the annual intake had been pushed upstream.

It was a fascinating study of an irrigation system that was out of use because of silt. Silt again

showed its baneful effects on the works of man, by choking up canals. It had been necessary to clean out the canals, month after month, until mounting silt banks on each side made more and more work to keep the canals free of the deposits, until finally the task was too great. The canal was abandoned, other canals were dug, and they in turn were abandoned until the project fell into disuse except for a much reduced area that was irrigated with clear spring water.

Prosperity, the support of the center of the Golden Age of China, was gone, and this region that had been the most populous and powerful of China fell into decline because of silt.

Again, whence came this silt? In our search for the source of this water-borne material, we went back into the drainage area, where we found the landscape riddled with great gullies that had cut into the loess mantle. We estimated that some of these erosion ravines were 600 feet deep.

It was in these uplands that we made a great discovery. Here in the midst of labyrinthian gullies were temple forests, like emeralds, set in yellow-brown landscapes.

A detailed study of a number of these temple forests revealed that no erosion of the soil was taking place within the protected forests. It was plain that the present climate would support a complete cover of vegetation, such a cover as would prevent the kind of washing of the land we noted on all sides. Here was evidence that the wasting process of erosion had damaged the land enough to account for the decline of this region without an adverse change of climate; the temple forests themselves were proof that the present climate would support a generous growth of protective vegetation. In other words, it was not necessary to invoke adverse climatic change to account for the decline of North China.

It was then I knew that soil erosion, unless controlled, can undermine a civilization. Here then was the process of erosion accelerated above the geologic norm, and I knew also that for proper evaluation it was necessary to measure it experimentally to determine what effect different types of soil cover would have on erosion and runoff. Thus from this time, 1923, I began a series of experimental studies of soil erosion, as are hitherto reported.

III

UPON my return to the United States in 1927, these experimental studies of soil erosion were continued under the United States Forest Service, and in 1933 I was called to Washington to assist Hugh Bennett in organizing the movement for land conservation in the United States. The basic principle of the new movement was, in the words of Hugh Bennett, "to treat the land in accordance with its needs and adaptabilities."

This was a new thing in agriculture. For, with the exception of three of them, the State Experiment Stations had completely ignored the significance of soil erosion, with disastrous effects on the validity of many fertilizer experiments. Strange indeed it was that a fertilizer experiment of 30 well-arranged plots should be observed and studied for 40 years by soil scientists without discovering that soil had been eroded off as much as 12 inches from some of the plots and filled in on others—sufficient to invalidate the entire experiment. Little wonder that farmers were unable to explain the occurrence of "clay galls" in their fields, or why dark soil "changed" to light-colored soil.

To treat the land in such way as to safeguard the physical integrity of the resource was, therefore, something new in American agriculture, and to do so in accord with scientific experiments was something new in civilization. To conserve soil by this approach is as significant in the history of agriculture as the invention of the plow. It is an outstanding advance in the march of civilization, and its significance will not be fully appraised for generations. It is too big, too tremendous, a fact to be fully comprehended by the country now, or by professional agriculturists in general.

Soil conservation, as worked in the land, is an expression of a people to survive; it is the mark of a virile people who put science to work in the common things of life for its own survival.

A thought that I cannot drive from my reflections about the agricultural lands of the world is that across the ages human beings everywhere have been prone to exploit productive land. From earliest time the soil has been mined for the last ounce of productive value exchangeable for what we have called wealth—wealth expressed in terms of money.

After decades of study of the land and what people have done to the land over wide areas of the world—the United States, Europe, much of Africa, and a large part of Asia—I have learned that man has been his own worst enemy. From continent to continent he has done far more to impoverish and waste his base of productive soil than he has ever done to conserve it. He has stripped the forests from the hills and the grasses from the prairies, and with his plows has laid bare the fragile soil to the wrath of driving wind and tearing torrents of rain.

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Today, not much is left anywhere on earth in the way of virgin soil. A few isolated areas of some importance occur here and there, such as the untouched lands of the Amazon and Orinoco Basins and scattered undrained swamplands. The frontiers of the world have been very largely annihilated.

World War II struck me in Syria, where I had about completed a survey of that ancient country of the Near East, known as the Cradle of the Human Race, along with the old, old lands of northern Africa.

There I found hundreds of thousands of acres of agricultural land that once had contributed to the support of powerful civilizations stripped of its productive soil, often to bedrock. The land was gone and with it the people and the civilizations the land had supported. One area, typical of many, my memory retains vividly. I called it the Graveyard of a Hundred Cities. From this bleak, skeletonized area of approximately 1,150,000 acres, little is left but rocks and ruined cities, some of them buried with the soil that once supported them. Their very names are lost in the debris of wasted land, vanished people, departed civilizations.

In many places I found the remains of ancient structures, as rock-walled terraces that were built to save soil and to catch the rains for the benefit of agriculture. These remind us of man's defeats by man—of his raids and wars and exploitation that brought neglect and debauchery to his good land.

IV

BETWEEN my first trip to China in 1922 and this one, I have had the outright good fortune to be closely associated with the great movement in the conservation of soil which has developed in the United States pretty largely within a single decade. This vast program of land defense and repair was started by the Soil Conservation Service of the United States Department of Agriculture. It began as the Soil Erosion Service in the Department of the Interior, and by act of Congress was transferred to the Department of Agriculture when the first soil Conservation Act—Public No. 46—was adopted in 1935.

This program, today far-reaching, followed years of pleading by a few specialists that something be done to preserve the base of our American agriculture. The pleading proceeded across decades before the lawmakers were convinced that something needed to be done. It was pointed out that a permanent agriculture could not be maintained without permanently productive soil, and that millions of acres had been ruined—and the damage proceeding at an accelerating rate.

Erosion experiment stations were established. The findings of research, covering more than a hundred thousand measurements of soil and water losses from various kinds of land used for many purposes, showed at once that the estimates of those who had been shouting in the wilderness were too small.

When the Soil Conservation Service began to operate its program of erosion control and prevention, of water conservation, and good land use, it most fortunately based its program on physical laws that were just as substantial as the fact that water will not run uphill.

This fundamental concept of the Service—Hugh Bennett's idea, and probably the greatest contribution of all time to agriculture—was that erosion could be controlled only by treating the various kinds of land according to their individual capabilities and adaptabilities. This kind of program obviously called for the use of many different kinds of practical farm measures, used singly and in combination. Such treatment of the land was a coordination of the skills of various specialists, such as erosion specialists, agronomists, agricultural engineers, foresters, range managers, and biologists.

Moreover, the land was treated on a physiographic or drainage area basis—for running water is no respecter of persons or property lines. To control erosion and unabsorbed storm waters successfully, experience has shown that measures must be planned on a drainage basis, so that farms lower down on slopes are protected from erosion waste and runoff from farms higher on the slope.

The program in the main proved successful from the very beginning. The demand for more and more soil conservation came from every part of the nation—and from Puerto Rico and Hawaii. Specialists from most of the countries of the world have visited the United States to study the program of the Soil Conservation Service. Many other nations —in Africa, in Mexico, in South America, in Australia—have set up Soil Conservation Services or similar organizations of their own.

In the United States, 2 million farmers on their own initiative have established, under State acts, 785 soil-conservation districts in 42 States, comprising approximately 460 million acres of land.

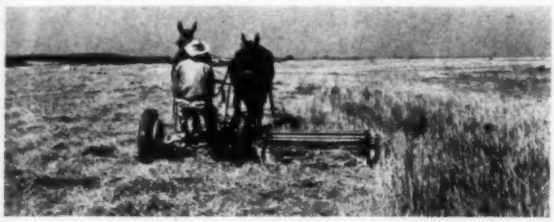
To my mind, the Soil Conservation Service has brought into being the most significant movement in agriculture in the Christian era. I am convinced that those who study this program and its accomplishments will agree with me.

LEGUME SEED AND CONSERVATION FARMING

By J. N. LOWE[1]

GREAT things are seldom accomplished by a stroke of the pen. Those who live below the corn-bread and "pot likker" line well know that the best corn meal that can be had is produced by the old-fashioned water mills that slowly but surely grind "each turn" of corn. So it is with nature and changing the habits of people.

Southern farmers for generations have depended upon buying the seed of soil-improving crops from commercial sources. In fact, until recently it was considered impractical, if not impossible, to produce and harvest seed of several winter legumes and the seed of such pasture legumes as white Dutch clover in the Southeast. But the mills of time are grinding away and the change from the "seed buying" habit



Harvesting lespedeza seed with a simple combine attachment on farm without power equipment.

to one of "seed producing" is steadily becoming more apparent.

Agronomists of the Soil Conservation Service recognized in the beginning of their work that a plentiful supply of locally produced seed was essential to a sound soil conservation program. They realized that a conservation program could be no stronger than the seed production program on which it was based.

Many times farmers were not financially able to purchase the necessary seed and even when the funds were available through the AAA, as they were in 1941 in Alabama, the seed was not available at a reasonable price and many times not at all. Often when seed was available, delivery was delayed beyond the most desirable planting dates.

Even in the days of the old Soil Conservation Service erosion-control demonstration projects and SCS-CCC projects, "Establish a seed patch and produce the seed you need at home" was the slogan

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Harvesting 45 pounds per acre of white Dutch clover seed from windrows in pasture, with a combine. A byproduct that often exceeds the grazing value.

of technicians and cooperating farmers alike. Organization by farmers of soil conservation districts to solve their conservation problems has stimulated further interest in the local production of seed.

The Holmes County Soil Conservation District in Mississippi is one of the best examples of how the district organization has helped farmers to produce and save their seed on the farm. In 1941 the farmers with whom the district was cooperating produced 108,200 pounds of annual lespedeza seed, 637,700 pounds of winter legume seed, and 22,600 pounds of white Dutch clover seed. Progress in seed production can be better understood when it is further explained that these same farmers in 1937–38 saved no seed of these crops. Since then they have established 197 seed patches from which legume and grass seed was harvested in 1942.

In 1939, with the help of the SCS-CCC camp at Dothan, Ala., the Wiregrass Soil Conservation District was furnished 250 pounds of blue lupine seed

Where there's a will, there's a way. Lack of equipment did not prevent this farmer from saving crimson clover seed from a 1-acre seed patch.

for establishing seed patches. From this small beginning the cooperating farmers harvested more than 1,500,000 pounds of blue lupine seed in 1942. This seed will contribute materially to the protection of the soil and the nitrogen supply so urgently needed for normal crop production as well as increased production in the war program.

Secretary Wickard said, "The farm programs that were a peacetime blessing are a wartime Godsend." This certainly expresses the feeling of the farmers who are participating in the soil conservation district seed-production program. Farmers generally are beginning to realize the seriousness of the nitrogen shortage and that their only hope is to turn to legume nitrogen. Farmers who are working with the districts have laid the groundwork for such an emergency.

In Mississippi and Alabama, farmers cooperating with soil conservation districts in 1941 harvested from their seed patches more than 5,701,000 pounds of seed. This included 1,942,296 pounds of annual lespedeza, 410,000 pounds of crimson clover, 167,000 pounds of blue lupine, 842,000 pounds of bur-clover, 37,250 pounds of red clover, 278,246 pounds of white Dutch clover, 110,000 pounds of crotalaria, 1,090,469 pounds of pasture grass, 235,325 pounds of sericea lespedeza, and 588,400 pounds of other legume and grass seeds essential to conservation farming.

The widespread recognition of seed patches as an essential part of a conservation farming program represents a major advance in Southern agriculture. The introduction of the all-crop harvester (small combine) has established the seed-production habit as an institution in many soil conservation districts.

PRODUCTION THROUGH CONSERVATION

(*Continued from page 150*)

crop adaptation, seed production, inoculation of seed, abundance of soil organic-matter and plant food, and many other angles; strip cropping must be considered from the farm organization standpoint as well as from the angles enumerated under cover crops. How can a "single practice" be expected to control erosion when so many factors—farming practices, field arrangement, soil fertility, climate, soil texture, etc.—all combine to produce erosion?

IT is my opinion that any attempt to control erosion should first be considered from the standpoint of proper land use. Field rearrangement for proper land use—which is the basic purpose of land use capabilities—and the water-disposal system, are the two essentials in any erosion-control program. The crop rotation, and simple or "annual" practices can then be built on a sound framework. The wholesale use of so-called simple practices, without first doing the basic reorganization work, is merely postponing the real job. It's possible to keep on driving an automobile with a bent frame if there is plenty of money to keep on buying tires, but to get real service from the car and the tires, the most satisfactory and economical procedure is to correct the real cause of the trouble—the bent frame.

LET us go all-out for increased production and assist in all possible ways to meet the production goals; but let us not forget that the application of single practices may be only a stop-gap, pointed toward increasing immediate production; that wholesale advocating of simple practices is beset with danger; and that we cannot afford to lose sight of the fundamentals in erosion control.

BETTER SOIL—MORE MEAT AND MILK

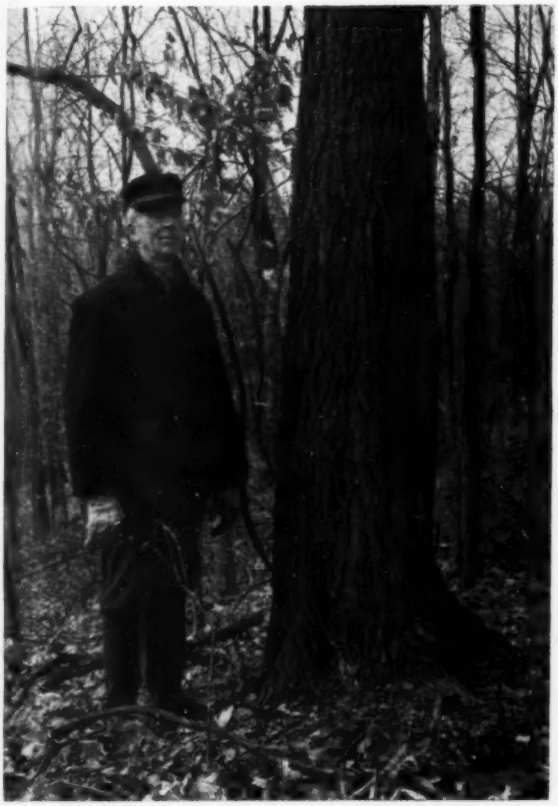
A STUDY of the production records of cooperators and noncooperators in the work of the Soil Conservation Service in southwestern Iowa and northwestern Missouri was made recently. It shows that farms using a good crop rotation, including grasses and legumes and other soil-conserving practices, produce more feed per acre and market more livestock per acre than ordinary farms.

According to this study, there was not much difference in the yield of corn and oats. The yields of hay on the livestock per acre than ordinary farms.
per acre, while hay on the farms of noncooperators averaged 1.6 tons per acre. Bringing grain and hay together the cooperating farms averaged 2,884 feed units per 100 acres, while the noncooperating farms averaged only 2,704 units per 100 acres.

The cooperating farmers marketed $169.50 worth of livestock for each $100 worth of feed. The noncooperating farmers averaged only $149 for each $100 worth of feed produced. Part of this difference may have been due to more efficient management, but most of it was probably due to the fact that the soil-conserving farmers had more roughage of higher quality, according to Dr. A. C. Bunce, of Iowa State College. A more detailed account of this study was published in the *Iowa Farm Economist*, Vol. VIII, No. 3, March 1942.—A. T. Semple.

BLACK LOCUST FOR GOOD LAND USE AND PROFIT

BY J. A. GIBBS AND J. C. CRAIG[1]



A specimen black locust tree in the 1904–06 planting.

MORTON T. ELLIOTT, who owns and operates a 638-acre farm near New Harmony, Ind., has planted black locust trees since 1895. He has found that the locusts not only do a good job of establishing cover, but also produce a profitable crop of posts.

Mr. Elliott plants locust chiefly to make use of short, steep breaks that occur on otherwise gently rolling land. Years ago his father advised him to "grow valuable timber" on lands too steep to farm. Thus it was that in March 1895, with a team and wagon and a man to help him, he went to an old "Rappite" cemetery and grubbed a wagon load of black locust root sprouts and planted them on one of his steep breaks. He relates today that as he and his man were driving home with the first load of sprouts, a neighbor inquired what they were doing. After hearing Mr. Elliott's explanation the neighbor laughingly remarked, "You'll be dead before those sprouts ever make posts." This first planting has yielded two good crops—one of hundreds of posts cut in 1918, and another crop now on the ground ready to cut.

He secured more sprouts from the same source in the spring of 1898, and then in 1904 made his largest planting of over 7 acres, this time using 7,600 seedlings purchased from the Kansas State Agricultural College. He replanted 1,000 seedlings in 1904 and 400 more in 1906 in this 7-acre planting. Other plantings were made in 1916 and 1920. His next planting, in 1930, just about completed his use of seedlings, for he has found that with locust established where needed on his farm he can reproduce the stands successfully from sprouts.

The lands that Mr. Elliott is using for black locust occur mostly in the form of long, narrow, steep strips not over 50 to 60 feet wide, and varying in size from a part of an acre to over 7 acres. Slopes vary from 15 to 40 percent and represent practically all exposures. The soils, developed from deep calcareous loess, include both silt loams and sandy loams of the Princeton series. Throughout the decades sheet and gully erosion had taken quite a heavy toll of soil.

The native cover of these sites prior to planting consisted chiefly of native grasses, weeds, shrubs, and lone trees of sufficient density in most cases to require some cleaning of the site prior to planting. No other site preparation operations, such as plowing, were applied. Aside from the first two plantings, when root sprouts were used, 1-year-old seedlings have been the rule. Mr. Elliott said he has learned that better results can be obtained by using large, sturdy plants. Stock has cost about $3 per thousand.

In the main, the method of planting has involved the use of a common crowbar and planting dibble, with no scalping in advance of planting. The number of trees planted per farm day has averaged about 500 at an average cost of about $1.50, using a 6- by 6-foot spacing.

Following the planting on his many areas Mr. Elliott has faithfully practiced prompt replanting when necessary and has released from competing vegetation practically all his plantations during the first 2 years after planting. This release cutting has cost about $3 per acre. As a general rule, his plantings are not fenced against livestock, because this would require an excessive amount of fence for small, narrow areas. Therefore, most of his plantations have been grazed periodically along with adjacent fields in his crop rotations. Mr. Elliott admitted, however, that he could get better growth with complete protection from livestock. No fires have ever occurred in any of his plantings.

[1] The authors are, chief, regional forestry division, Dayton, Ohio, and district conservationist, Soil Conservation Service, Evansville, Ind.

In establishing all his plantations Mr. Elliott has made use of his own farm labor, mostly at times when field work was not urgent. He hires full-time year-round labor and is interested in providing work for them during slack seasons. He has found that the various steps involved in establishing and releasing plantations, and cutting and hauling the posts, are effective and profitable labor outlets, particularly during the winter months.

The various approximate costs involved in the Elliott black locust plantings, based upon the purchase of trees and the use of home labor, are outlined below.

	Cost per acre
Stock	$3.00
Planting	3.30
Releasing	3.00
Cleaning	8.00
	17.30

In addition to these initial casts Mr. Elliott figures he has an annual cost of about $1 per acre for taxes, maintenance, and interest. This makes the total cost over a 20-year period, assuming this to be the time required to produce a crop of posts, of about $37.50 per acre.

The results of the plantings are shown in the following table which was prepared after a study by the authors, assisted by Mr. Elliott.

In making the study to obtain the data in the above table, plot estimating was employed. Because of the small area of most plantings, the plots were usually a large percentage of the total area of the plantation. The diameter of all trees was measured with a diameter tape, and heights were taken with an abney hand level. Mr. Elliott provided the estimate of the number of posts in each tree on the plots.

It will be noted in reviewing the preceding table that the two earliest plantations were clean-cut for posts. In the other plantings, only occasional trees have been removed on a light selection basis. Unfortunately, no record is available of these latter cuttings and the table does not include the posts that have been removed from the 1904 to 1930 plantings. It is also impossible to present a figure on the amount of fuel wood that was obtained from the tops of trees cut. Thus the figures presented in the table constitute a conservative summary of the total production of wood per acre.

In all post harvesting and selling operations Mr. Elliott has rigidly adhered to the practice of doing his own cutting with his own farm labor. All posts sold have been cut and hauled to a "post yard" near the barnyard and here they are graded and piled in neat crisscross piles. Farmers have been coming to this post yard for over 20 years to buy posts. Incidentally, Mr. Elliott expressed the thought that good merchandising principles apply to selling posts as well as to any other product of the farm.

Elliott's average total cost over many years of cutting and splitting has been about 3 cents per post, and about 1 cent per post for hauling, grading, and piling in his post yard ready for sale. His grading scheme has been about as follows:

1. Line posts:
   - a. Length, 7 feet.
   - b. Round, 3 grades, (1), (2), and (3).
     - (1) 4- to 5-inch top.
     - (2) 3- to 4-inch top.
     - (3) Less than 3-inch top.
   - c. Split: 2 grades, (1) and (2), depending upon quality, both with not less than 4-inch face:
     - (1) Firsts.
     - (2) Seconds.
2. Corner posts (mostly round and including chiefly those posts difficult to split):
   - a. Length, 7 feet.
   - b. Diameter, 10- to 12-inch top.
3. Gate posts (from best straight trees, mostly split):
   - a. Length, 9 feet.
   - b. Minimum face, 10 to 12 inches.

Prices received for the sale of posts in Mr. Elliott's post yard at the farm have varied over the years, but the following is about the average received:

1. Line posts:
   - a. Round, 20 cents.
   - b. Split, 25 cents.

Growth of black locust as measured August 1941

[M. T. Elliott farm, New Harmony, Ind.]

Date planted	Origin	Average diameter breast high	Average height	Trees per acre [1]	Date clear cut	Posts produced per acre per year	Natural reproduction
		Inches	*Feet*				
1895	Root cuttings				1918	[2] 100	
1898	do				1920	135	
1904–6	Seedlings	10.6	75	76		40	Tulip, elm, ash, sugar maple, soft maple, sassafras, hackberry, hickory, sycamore, shrubs.
1916	do	10.6	65	120		61	Ash, tulip, red oak, white oak, sassafras, hickory, black walnut.
1920	do	7.5	60	285		90	Ash, tulip, sugar maple, hackberry, red bud, basswood, cherry, blackberry, box elder.
1930	do	4.5	43	384		97	White oak, basswood, black cherry, box elder, chestnut-oak, ash, hickory, elm, hackberry, shrubs.
1918	Stump sprouts	6.5	50	292		51	Ash, elm, blackberry, buck brush, elder.
1920	do	6.1	50	560		123	Ash, black walnut, sassafras, oak.

[1] Number of black locust trees found on ground August 1941.
[2] Line posts only considered.

NOTE.—Since this article was written, 1,500 line posts per acre have been cut from the 1904-6 planting, leaving all trees under 8 inches.

2. Corner posts, about 50 cents.

3. Gate posts, about $1.

In reviewing these prices it must be kept in mind that Mr. Elliott's farm is in a geographical region where native black locust is quite common for some distance north into Indiana and south into Kentucky. This and the fact that these prices are "on the farm" undoubtedly account for the rather low prices received.

From a purely economic standpoint Mr. Elliott's black locust plantings can be outlined as follows on the basis of average totals per acre per year over a 20-year period:

Costs:	
Site preparation, stock, planting, etc	$0.87
Taxes, maintenance, interest, etc	1.00
Cutting and handling annual post production of about 85 posts per acre at 4 cents	3.40
Average total cost	5.27
Income:	
From sale of 85 posts per acre per year at an average price of 25 cents	21.20
Indicated net income per acre per year from black locust plantings	15.93

While it is impossible to present an accurate financial account of just what Mr. Elliott's black locust plantings have meant to him and his farm business it can be said that he has sold thousands of posts which have added hundreds of dollars to his annual cash income. In this connection he stated that the annual income from locust posts has just about covered the taxes on his entire 638-acre farm. A good example of a cutting and sale of posts is seen in the February 1920 harvest in his 1898 planting—a total of 668 posts was cut and sold from an area of one-fifth of an acre in this plantation. The following is a copy of Mr. Elliott's records covering this operation:

569 posts sold at 35 cents	$199.15
5 posts sold at 30 cents	1.50
94 posts sold at 25 cents	23.50
Total received	224.15

Deducting Mr. Elliott's average costs of establishing and maintaining his locust plantings, and with no deduction for labor in cutting and hauling since additional posts and wood from the tops was of sufficient value to cover these labor costs, this one-fifth of an acre netted a cash income of $216.25 or an annual revenue of $9.82 net.

In addition to cash income derived from the sale of posts, hundreds of posts cut from these plantations have been used in fence construction and maintenance on the Elliott farm. Considerable quantities of wood have been cut also from locust tops and utilized for fuel.

In the management of over 25 acres of his black locust plantations, Mr. Elliott has found that natural reproduction of the more common native hardwoods as indicated in the table, will take over the areas gradually if not controlled.

In order to obtain the best sprout reproduction he recommends that trees be cut low to the ground, as this tends to ensure against breakage of sprouts during wind or sleet storms.

Mr. Elliott points out that he has derived many other benefits from his black locust plantings aside from the production of posts and wood. He values his plantings in the conservation of soil and water, in providing cover for wildlife, in serving as windbreaks and in making the farm more attractive.

BUILDING A TERRACE WITH A ONE-WAY PLOW

BY EDD ROBERTS[1]

Building a channel-type terrace with a one-way disk plow at the Cherokee Experiment Station, Oklahoma

TERRACES can be constructed with one-way plows economically and satisfactorily. In the wheat country this method has one distinct advantage—it is less trouble for a wheat farmer because he has such a plow available on the farm.

On June 17, 1942, tests were made at the conservation experiment station at Cherokee in northwestern Oklahoma. Besides the writer, those participating were County Agent A. R. Jacob, Harley A. Daniel, project supervisor of the station, Engineer M. B. Cox, and H. C. Hyer, conservationist in the wind erosion area. In two different tests the channel-type terrace was built at the rate of 300 feet per hour and 350 feet per hour. This means that the average wheat farmer will build from one-half to three-fourths of a mile of terrace per day with an 8-foot one-way plow. Such a plow was used in the test at the Cherokee station and it was not mounted on rubber.

It required 12 rounds to build the channel-type terrace shown in the photograph. It took 8 rounds to construct the ridge of the terrace and 4 rounds to complete the channel. The capacity of the channel was 17.3 square feet. The height of the ridge was 1.8 feet.

[1] Extension soil conservationist, Western Gulf Region, Soil Conservation Service, Stillwater, Okla.

The terrace was constructed immediately after the wheat was harvested. The soil was in excellent condition for any type of tillage practice, as it was neither too dry nor too wet. The wheat had been combined, and a heavy covering of straw had been left on the land. The one-way plow cuts and handles the loose straw perfectly.

In Alfalfa County, where the experiment station is located in the heart of the wheat country of Oklahoma, it is estimated that 3,000 one-way plows are owned by farmers —practically every farmer has this implement and some have two of them. All farmers who use the one-ways also have the power to pull them since they have been handling their farming operations with tractors for some time.

Building the channel-type terrace with a one-way is similar to building a channel terrace with a turning plow. The ridge is built first merely by moving a 2-foot cut of dirt with each round for about 8 rounds. In constructing the channel, a land is laid off so that one border of it is the center of the ridge of the terrace, and the other border is 9 feet above the center of the channel. By plowing around and around this land, the dirt is pushed both ways out of the channel, and the dead furrow is left in the center of the channel.

In starting the construction of the terrace it should be remembered that the survey line of the terrace should be the center of the channel, and a line 9 feet below this should serve as the center line of the ridge.

Farmers in the wheat section of western Oklahoma have begun to use the one-way in building channel-type terraces. M. A. Davis, a wheat farmer southwest of Guthrie, who has had some 10 years' experience in terrace construction, likes the channel-type terrace in the wheat country because it is easier to cross with combine implements and farm implements than the high-ridged terrace. Allan Every, of Piedmont, west of Oklahoma City in Canadian County, and Loyd Long, of Garber, east of Enid, have adapted the channel-type terrace in the small-grain country.

FARMER ORGANIZATIONS COOPERATE FOR VICTORY

BY JOE J. KING[1]

Small farmers in the cut-over areas of the Pacific Northwest, if given the opportunity, can contribute "food and fibre" to the Food for Freedom program. Two soil conservation districts, cooperating with the Farm Security Administration's community and cooperative services section, are finding new ways to help provide the opportunity. It is pioneering work; but it has proceeded far enough to indicate effective methods for coordinating war efforts of county land-use planning and Federal action programs. Examples may be found in Skamania County and Snohomish County in Washington.

Seven years ago the Skamania County Land-Use Planning Committee called on the United States Bureau of Chemistry and Soils to advise on the suitability of the county's logged-off lands for general agriculture. The committee learned from the Bureau's report that 11,000 acres of logged-off land, if cleared, would be of excellent quality. They found, too, that practically all the county's farms lacked sufficient acreage to serve as economic family units. Actually, the average farm had about 15 acres of cultivated land.

On the basis of these findings the county commissioners purchased on the committee's recommendations an RD–8 bulldozer to clear logged-off lands. Land clearing charges were $6 per hour, which included time of operator, manager and operation, and moving the machine. In more than 4 years of intermittent operation, some 700 acres of logged-off lands were cleared and about 150 acres of fruit trees were "pulled."

Several serious difficulties appeared in the program. To begin with, the county commissioners also used the bulldozer on road maintenance and construction. Next, various misunderstandings developed from the lack of adequate farmer representation in the management of the machine. Finally, the bulldozer broke down frequently under the strain which it received from varied and heavy assignments.

Many farmers gradually began to disapprove of having the county operate the machine. Thus, when the machine wore out, plans were laid to organize a cooperative land-clearing association. Neighborhood, community, and district meetings were held. Farmers democratically discussed the practical operation of the proposed cooperative. Assistance was sought from Extension Service, Soil Conservation Service, and Farm Security Administration, and on March 31, 1942, several farmers actually organized and incorporated the Columbia Farmers Cooperative, Inc.

The county USDA War Board, on April 27, issued this statement: "The War Board feels that additional land within the area should be cleared; that this program is vitally important now, during the emergency, to stimulate necessary food production, but is also approved as a long-time program, whereby individual farm pasture and crop acreage can be systematically increased to insure economically sized farm units."

This land-clearing program promises to bring scores of *underemployed* small farmers into maxi-

[1] Chief, regional cooperative section, Farm Security Administration. The author acknowledges assistance from letters and documents written by W. S. Gillard, H. J. Card, T. A. Steele, Dale Wroe, Ray Davis, W. C. Pettibone, Gerald Oftebro, C. W. Peters, and others.

mum production of war-needed food and fibre. FSA Supervisor Wroe, in commenting on the association, remarked that "if these farmers could develop their units so they could stay on the farms and not have to work for nothing it would give them an incentive to become better farmers and also raise the standard of living for their families besides putting more good agricultural land into production . . . The additional cleared land in these two counties will add greatly to the increased production of food to meet the war needs, as this will put considerably more food crops on land which is now nonproductive."

Without a great deal of difficulty, the new cooperative located a used, but reconditioned, RD–6 bulldozer. Application was then made to Farm Security Administration for a $4,500 cooperative association loan. The loan was approved; and the cooperative got under way with a sign-up of 5,000 hours of clearing work.

Cooperative principles were followed—one member one vote, equitable membership requirements, patronage dividends, etc. Membership fee was $5, with a $3 deposit for each acre to be cleared. A service charge of $6 per hour was set for operations. All work was for cash. The amount of service to any one member in a year was limited to 150 hours.

Of most importance was the fact that the cooperative was anxious to conduct its land-clearing activities so as to bring about correct land use. To achieve this objective, a memorandum of understanding between the Columbia Farmers Cooperative and the Underwood Soil Conservation District was written. The cooperative agreed (1) to provide a tractor operator and to keep the machine in satisfactory mechanical order; (2) to furnish a manager who would efficiently route the bulldozer; (3) to provide a trailer for moving; (4) not to clear land that had a capability classification of worse than class IV (class IV is defined as "land that, from the standpoint of inherent soil characteristics and environmental features, is not suitable for regular or continuous cultivation with the production of moderate to high yields of the adapted crops, but with adequate protection is suitable for uses that may involve short periods of cultivation"); (5) to make the bulldozer available to all land operators who were members of the cooperative as long as they could pay the hourly scale; and (6) to encourage all land operators who use the tractor to have the district prepare a plan for soil conservation operations.

The district, in turn, agreed (1) to make land-capability classifications; (2) to encourage land operators to use the bulldozer; (3) to provide technical assistance and supervision in carrying out conservation practices; (4) to make district equipment and materials available in order that correct land use operations and practices might be obtained; (5) to furnish power to move the bulldozer and trailer; and (6) to prepare conservation plans.

Today this agreement is in effect. The cooperative is functioning. Land-clearing costs to the farmer average around $17 per acre. After a month's operation, more than 50 acres have been satisfactorily cleared. And so it is that scores of Skamania County "small farmers," underemployed and in most instances reluctant to desert the land for the lure of urban employment, are progressively increasing their production of critical foods for the United States Department of Agriculture food for freedom program.

While the Skamania County group is mainly concerned with increasing the amount of good land from which more critical foods may come, the Snohomish County group is helping to maintain an adequate supply of war-scarcity "fibre." Several years ago, when the Snohomish County Land-Use Planning Committee dug into the problem of its small cut-over land farmers, it discovered that land clearing alone was not enough to meet the problems. The county had between 75,000 and 80,000 acres of farm woodland, mostly in second growth. Much of this acreage was suitable only for forest. The individual farmer, who seldom had more than 75 or 100 acres of timber, found it uneconomical to get out his few cords of pulpwood or poles and market them alone.

Not until 1938, when the Soil Conservation Service opened its CCC camp in the county, did tangible action start on solving the problems. The Service, after checking on erosion conditions, discovered that the woodland areas played an important role in determining the amount of land erosion and in determining the economic condition of the small farmer. Thereupon the representatives of the agency, along with the county agent, initiated an active educational campaign. They pointed out to farmers the value of their forest lands, both in relation to conservation of water and soil and to income from woodland.

Meetings were held. Farmers discussed their woodland problems. As a result of their discussion, they decided to organize a cooperative association to achieve two main objectives. First, they would help farmers with small cultivated acreages and limited wood lots to market their forest products efficiently and profitably. Second, they would teach sustained-yield principles so that the farmers might "farm" their woodland.

The Washington Forest Products Cooperative Association, the first of its kind west of the Mississippi, was incorporated in May 1940, with 45 charter members. Membership was open to farmers "owning

5 acres or more of woodland, or renting 10 acres or more." Membership fee was $2.50. A seven-man board of directors directed the association, with six elected by the membership and the seventh appointed by the Washington State Director of Agriculture. The association employed a farmer-manager. All normal cooperative principles were to be followed, including one member one vote, patronage dividends, and others.

The association signed a blanket marketing agreement with each member to handle his forest products, "from tie timber to Christmas trees to cascara bark." It possessed the authority to pool members' products, to determine scales and standards, to select selling agencies in or out of State, and to sell either wholesale or retail. From May 1940 to December 31, 1941, the association had a total income of $35,497.87. Its total deductions were $34,984.72, leaving a net income of $513.15. By May 1942, its membership consisted of 62 farmers.

The organization, concentrating on poles and piling, experienced no difficulty in marketing its products; but as its membership increased, the association discovered an increasing need for operating capital. Many members, having no other income for family living except the sale of fuel timber, required cash advances to carry them through the cutting season.

Unable to obtain the credit from any other source, the association applied to Farm Security Administration for a direct cooperative association loan of $1,800. This amount would permit a $3 cash advance on each of 600 cords. The loan was approved; and the money was soon put to work, helping to provide wood fuel for the Puget Sound area.

As one part of FSA loan approval, it was stipulated that the association would "enter into a working agreement with the Soil Conservation Service, United States Department of Agriculture, providing for the continued supervision and assistance of the Soil Conservation Service in carrying out the cordwood marketing activities of the borrower." A memorandum of understanding, consequently, was signed on August 14, 1942, between the Snohomish Soil Conservation District and the Washington Forest Products Cooperative Association. The district agreed (1) to provide technical assistance; (2) to furnish limited office space and clerical help; (3) to guide the cutting in sustained-yield principles; (4) to advise on market conditions; and (5) to make field conservation plans. The association, in turn, agreed: (1) to develop sound forest management and sustained yield; (2) to practice conservation methods; and (3) to seek technical advice from the Snohomish Soil Conservation District.

Not only is this cooperative organization of small farmers contributing wood fuel at a time when city wood fuel supplies are low, but it is also providing a source of supplementary income to people who, for one reason or another, are reluctant to enter full industrial employment. The Washington Forest Products Cooperative Association is serving a real wartime function.

Other activities of a similar nature are beginning in several rural areas of the Pacific Northwest. All have the major objectives of helping underemployed small farmers bring their labor and land into full production of war needed food and fibre. Equally important to a fighting democracy, these activities show a promising way for effectively coordinating agricultural planning and action programs.

THE USE OF KUDZU IN A ROTATION SYSTEM

By E. C. RICHARDSON [1]

A large acreage of cropland in Alabama has been so severely damaged by erosion that it is no longer suitable for cultivation, and has been abandoned. A still larger acreage has lost so much soil that it is being cultivated at a loss, and is approaching a condition that may result in abandonment. These losses in soil resources have resulted from continuous clean cultivation of sloping land without sufficient protective vegetation in the cropping system to prevent erosion.

Much of this eroded land will be needed for cultivation in the future; but it must be reconditioned before it will produce satisfactory yields of most crops. Probably the best way to restore the productivity of these eroded soils is to cover them for a period of several years with a dense growth of deep-rooted vegetation that will control erosion, increase absorptive capacity, and add nitrogen and organic matter. Perennial legumes that will grow vigorously on poor land, and also will produce forage for livestock, are ideally suited for the job of rebuilding these run-down soils.

Until recently, very little attention was given in the Southern States to the possibility of using perennial legumes in crop rotations. In many instances, cultivation was continued until the land was eroded to such an extent that it no longer was fit for crop production; then it was abandoned to broomsedge, poverty grass, common lespedeza, and pine trees that might come in through

[1] Project supervisor (Research Project No. 2), Soil Conservation Service, Auburn, Ala. The article is adapted from a paper presented at the meeting of the Association of Southern Agricultural Workers, Memphis, Tenn., February 6, 1942.

natural reseeding. After a few years under this type of cover, the trees were cut and the land was brought back into cultivation for a few years—until further erosion again caused it to be abandoned. Each period of cultivation was shorter and each period of rest was longer than the preceding one. Such a system merely delayed the final destruction of the land's usefulness.

It is obvious that even if this rotation of row crops and pine trees had effectively controlled erosion it would not have been good land management in a section where the acreage of cropland per capita of farm population already was too low. It is essential that these eroded soils be treated in such a way that they will give a continuous return in forage or other crops while they are being protected from the destructive forces of erosion.

In 1916 the Alabama Agricultural Experiment Station planted an area to kudzu. It was allowed to grow until 1919 when the land was plowed and devoted to the production of corn, oats, and sorghum. Records were obtained for 11 years of the yields on this area, and on an adjoining plot where kudzu was not planted. For 4 years annual corn yields were increased approximately 20 bushels per acre. For 7 years annual oat yields were increased about 7 bushels per acre. Sorghum hay yields were increased 1.25 tons per acre per year for 2 years. Results of this work were reported in the Alabama Experiment Station Bulletin 232.

On the basis of this and other work at the Alabama station, kudzu was given an important place in the erosion-control program of the State from the beginning of the Soil Conservation Service program. Approximately 2,000 acres were planted to kudzu in the Dadeville Project area in 1935, the first planting season. Most of it was planted on land that had been abandoned to broomsedge, shrubs, and trees. In practically all instances the best land was retained for row-crop production. Fertilizer and clean cultivation were recommended the first year, but farmers did not appreciate the value of kudzu, and few of them complied with these recommendations. By 1938 a number of the kudzu plantings had developed sufficiently to supply some grazing. A few areas were cut for hay.

In 1939, two terrace interval strips of well-established kudzu were plowed and planted to corn. This was done to determine and demonstrate the value of kudzu as a soil-building plant and also to determine whether or not it could be handled with the ordinary farm equipment that was available.

Above.—Kudzu planted on Cecil soil in 1935 had developed sufficiently to harvest hay in 1938 and 1939; in 1940 it was plowed and followed by corn—note kudzu in corn after last cultivation.

Below.—Same field as above, at maturing of corn; latter yielded approximately 38 bushels per acre.

The kudzu vines were cut with a disk to prevent balling of the residue in the plowing operation. In March, after disking, the land was flat-broken, allowed to settle, and then bedded. In late April, phosphate was applied in the drill and the corn was planted in the water furrow.

The Kudzu growth was controlled by plowing until the corn was approximately 30 inches high. It was allowed to grow back and produce a cover for winter protection of the soil and to reestablish it for future hay production. Two complete cultivations of the corn were sufficient to control the kudzu growth, but not enough to eradicate it.

The yield of corn in these two strips was approximately 30 bushels per acre, an increase of about 20 bushels. When the corn was harvested, cattle were turned into the field and some excellent grazing was obtained. The residue of vines left on the land after grazing was sufficient to give considerable protection during the winter.

In 1940, further studies of the possibilities of kudzu as a soil-conserving crop in rotations were made cooperatively by the Soil Conservation Service and the Alabama Agricultural Experiment Station. For these studies 20 different areas of kudzu, from which hay had been harvested the previous year, were selected. These areas were located in the Piedmont, in Limestone Valleys, and in Appalachian Mountain and Coastal Plain regions.

As a typical example of soil conditions on land where these studies were made, an area of Red Bay soil, a medium-textured coastal plain soil, was said by the owner to have made from 5 to 7 bushels of corn an acre the year before it was planted to kudzu. Kudzu was planted in 1936 and was harvested

for hay in 1938 and 1939. The acre yield of corn in 1940 was 30 buhels, approximately a fourfold increase over the yield on this land before it was planted to kudzu. The stand of kudzu was completely restored by the end of 1941 growing season, and this area could again be plowed for corn in 1942.

The actual production cost, including phosphate and man and mule labor at current prices, was $5.80 per acre or $0.19 per bushel. The production cost on heavy clay soils was higher because of greater difficulties in soil preparation.

Results of these trials show that corn can be grown successfully in rotations with kudzu. Yields were increased approximately fourfold, and in many instances kudzu made enough growth by the end of the summer to protect the soil against erosion.

These results also indicate that the length of the rotation that will be feasible will depend upon soil conditions. On those severely eroded experimental areas where soil conditions were extremely unfavorable, recovery of the stand indicated that it probably will be necessary to allow kudzu at least 2 years in which to reestablish a dense ground cover. Recovery of the kudzu on the better areas was so rapid that it appears safe to assume that a good stand can be maintained where corn is grown every other year, provided no hay is harvested. It appears also that on these better areas corn can be grown the first year, kudzu hay can be harvested in the late fall of the second year and in the summer of the third year, and another crop of corn can be grown the fourth year.

There is a vast acreage of steep land in Alabama and other southern States on which less than 10 bushels of corn per acre is being produced. Under continuous cultivation this land is suffering more and more from erosion, so that yields are steadily decreasing. Rotations of kudzu and corn would bring larger acre yields of corn and also would control erosion.

Entire fields of this steep land are such that it will be most feasible to carry on rotations between kudzu and corn in alternate strips. In other places, rotations may be between kudzu and corn in two or more strips on the critical slopes through fields, while other parts of the fields may be devoted to rotations of cotton, small grain, and annual soil-conserving crops that can be seeded on the grain. By growing the major portion of the upland corn in rotations with kudzu on the steep cropland, it will be possible to develop simpler and more effective rotations on the better land. If most of the hay is harvested from kudzu in the rotations on the steeper cropland, more of the vegetation grown after small grain can be left on the land, to reduce erosion and increase soil fertility.

Although first consideration probably should be given to developing rotations with kudzu on the steeper cropland, this crop also may be used to advantage on other land. In many instances moderately sloping areas have been so eroded and depleted of organic matter that normal soil-conserving rotations are not fully effective. The residual effects following kudzu at the Alabama Experiment Station suggest the possibility of using this crop to build up the fertility and the organic content of depleted soils. After remaining under a dense cover of kudzu for a few years the land could be plowed for other crops. Normal rotations of cotton, small grain, and soil-conserving crops seeded on the grain should be more effective on land that has been built up by kudzu. The crowns that can be gathered when a stand of kudzu is plowed for cultivated crops can be used to plant the next area to be treated on the farm. Rotations with kudzu can be much longer on the better cropland than they can be on the steeper land discussed in the foregoing paragraphs. Although rotations of this kind have not been developed and tested in the field, it would seem that such rotations should receive careful consideration in future field research.

Like other crops, kudzu has its limitations. It does not grow satisfactory on the calcareous soils of the Black Belt, on very plastic subsoils, or on poorly drained soils. It must be fertilized with phosphate, particularly on severely eroded areas. Observations made in the field indicate that potash also will be necessary on soils deficient in this nutrient. Under average conditions, kudzu is not sufficiently established to be used for hay or grazing before the third growing season after planting. During the first two years, however, it should be interplanted with clean-tilled crops from which a return may be obtained. Mowing and grazing must be regulated properly to avoid serious injury to the stand.

Kudzu is not recommended as a crop to cure all the ills of southern Agriculture. However, its performance in the field has been such that it has earned a place on the farms of the cotton South where the problems of soil erosion, disastrously low corn yields, and low income are so prevalent.

Conclusions with regard to the use of kudzu in rotation systems are as follows:

1. Corn can be grown successfully in rotation with kudzu.

2. Increased crop yields as a result of turning kudzu have been noted for a period of 11 years; however, to control erosion effectively on sloping lands and maintain a stand of kudzu, the rotation should be much shorter.

3. On steep, severely eroded areas where soil conditions were unfavorable, 2 years were required for the kudzu to recover fully.

4. On areas where soil conditions were more favorable, recovery of kudzu was so rapid that it is safe to assume that a good stand of kudzu can be maintained where corn is grown every other year provided no hay is harvested. When it is necessary to harvest hay in the rotation, an extra year will be necessary for the kudzu to recover.

5. On depleted soils where erosion is not a problem, kudzu may be used to improve the soil.

War Pastures

On suitable soils, under humid conditions, the fertility of pastures can be maintained profitably at a level that will produce enough forage to carry at least one cow per acre, which is the equivalent of four or five ewes and their lambs per acre, throughout the grazing season. Another acre of similar productivity is required to raise the feed for a cow or a fattening steer during the winter or barn-feeding period.

Farmers have the choice of two procedures: They may carry their stock on pastures that supply merely a maintenance ration, and depend entirely upon harvested feed for the production of meat and milk; or they may make their pastures highly productive and obtain weight gains and increased milk yields from grazing. In view of the necessity for protecting and improving our soil and the scarcity and high cost of farm labor, it behooves farmers to increase the production of vital foods, such as meat and milk, by making their pastures yield more. This will enable them to avoid the serious mistake of the last war—breaking grassland that should not be plowed. More dependence on pastures will help farmers to produce livestock products at less cost, and will help all of us to avoid the disastrously inflated prices of the first World War.—*A. T. Semple.*

GREAT DIVIDE DISTRICT PIONEERS IN RANGE CONTROL PROGRAM

BY LLOYD A. ACOTT[1]

For nearly 45 years, competition for the spring-fall range in the Great Divide area of northwestern Colorado has been very keen. This region, between Fortification Creek and Little Snake River, some 12 to 20 miles north of Craig, has long been of strategic importance in livestock operations because of its location between high summer range and winter desert range.

Cattlemen, sheepmen, and dry land farmers have competed for control of the region. Cattlemen first came with their steer outfits in the 1880's. Cattle reigned supreme for a score of years, but the severe stocking of sheep ranges in southwestern Wyoming pushed two herds of sheep down into the Great Divide area as early as 1895.

These two herds paid only a short visit, however, for cattlemen threatened to prove at pistol point that possession was at least nine points of the law. Again, in 1901, a herdsman brought in his sheep, only to flee before the "persuasiveness" of the cattlemen. But, of course, this kind of range warfare couldn't go on forever. On January 24, 1908, sheepmen and cattlemen signed a range compromise at Baggs, Wyoming, whereby certain parts of national forest and public domain were recognized for sheep use.

As early as 1905, sheep were gradually replacing cattle in the Great Divide. Then, beginning in 1915 another kind of frontiersman came—the dry land farmer. Colorado newspapers had published glowing stories about the fertile soil and its abundant crops. The magic words had spread—"There's free land in Colorado!" Hundreds of people thronged through Craig and moved northward to stake homestead claims. Smoke clouds from burning sagebrush often darkened the horizon as land was eagerly cleared. The thriving little town of Great Divide sprang up, and soon 75 percent of the public domain had been filed upon.

For a while, during a period of "wet" years, farmers raised good crops in the new soil and prospered. Then food prices slumped; rain and melting snow had removed topsoil from the steep hillsides. This together with the return of "dry" years, which really were "normal" years, caused a general abandonment of the dry land farms.

This community drift fence between sheep and cattle ranges in the Great Divide Soil Erosion District was constructed of aspen posts which had been treated with zinc chloride.

Of the original 1,500 families who had settled in the Great Divide area between 1915 and 1930, only 47 families remained in 1937. The others had been driven out by drought, loss of topsoil, and poor markets. Sheep raising had finally become the dominant industry of northwestern Colorado, and most of the remaining homesteaders had quit wheat farming and shifted to cattle or sheep.

Thus, when Colorado's first soil conservation district was organized by the residents in the Great Divide area in December 1937, conditions were far from ideal. Approximately 150,000 of the total of 275,000 acres now included in the District were abandoned land—"wild land"—not controlled by anyone, owned by nonresidents, often badly eroded and usually grazed by everyone's stock. Much land had become tax delinquent, and the Moffat County tax assessor actually had no record of the addresses of people who had once owned some 20,000 acres. In a few instances, tax delinquency had continued for 18 years, largely as a result of the expense of obtaining tax title, and the low value of the land involved.

It was to meet these and other problems that landowners of the Great Divide formed the soil conservation district. In 4 years, they have established a more stable use of the range and have made a promising beginning in range restoration. Today, cattlemen, sheepmen, and farmers are working together to solve their common problems.

[1] District conservationist, Southwest Region, Soil Conservation Service, Albuquerque, N. Mex.

Through cooperation in controlled use, they are gradually restoring the land to its former value as livestock range. Newly seeded crested wheatgrass and western wheatgrass are replacing weeds on 3,500 acres of abandoned crop land.

Since these district supervisors and cooperators have pioneered in solving vexing range problems, Dr. H. H. Bennett, Chief of the Soil Conservation Service, asked for a special report on the Great Divide when he visited Colorado recently. Louis Visintainer, vice-president of the District Board of Supervisors, wrote Dr. Bennett, telling how the district has largely overcome the land abuses and confusion of the past half-century.

When the district was first organized, Visintainer explained, approximately 150,000 acres of privately owned land were not leased by anyone and were severely overgrazed. To make matters worse, these 150,000 acres were scattered throughout the district, intermingled with lands being operated by owners.

The district first tried to secure leases from absentee owners, but was unsuccessful except in a few instances. Since the former homestead tracts were in poor condition, lacked water, and customarily had been grazed free, the income from grazing was only about 1.6 cents per acre whereas the yearly tax assessment was 4.87 cents per acre!

The district urged Moffat County to acquire the tax-delinquent lands, but the commissioners explained that the existing State law made this an expensive procedure. At this point, the district supervisors requested the Federal Government to purchase some of the uncontrolled lands through the land utilization program. The supervisors believed that the Government could develop watering places, construct fences, and improve the purchased lands so that the entire range could be put on a paying basis.

The Federal Government agreed, and 37,000 acres have been bought. Land was purchased only from owners who wanted to sell, and was then leased by the Government to the conservation district which is now issuing grazing permits on these lands to local ranchers. The Government receives rental income from the land, with Moffat County getting one-fourth of the revenue to compensate for taxes formerly assessed against the land.

In the meantime, the district supervisors had continued to discuss the tax-delinquency problem with the county. Finally the chairman of the County Commissioners arranged to have State legislation introduced to make it less expensive for counties to acquire tax-delinquent lands. This bill became a law, and Moffat County acquired the tax-delinquent lands within its boundaries.

During 1940 and 1941, the district leased 14,000 acres of tax deed land from the county. Grazing permits are issued to about 50 local livestock operators, who use range lands leased by the district to graze their cattle and sheep, thus supplementing their privately controlled range. Under the county lease, the district has agreed to undertake range improvements costing 2 cents per acre per year and to pay Moffat County an annual rental of 90 percent of the return from county land. Improvement on county leased lands, made possible with AAA funds, have consisted during the past 2 years of the development of three stock water reservoirs and two stock water springs.

In addition to acreage leased by the district itself, individual ranches have leased an estimated 50,000 acres of unprotected land to be used in connection with district-leased lands.

The results to date are that the 150,000 acres of "wild" land have dwindled to a point between 15,000 and 20,000 acres. Trespass drift by livestock has been almost entirely eliminated. The grazing permits issued by the district provide for proper range use of lands covered by the permit and also of privately controlled lands, so that the range may be given a chance to recover. Stock water has been developed not only on the Federal lands but also on other lands controlled by the district and by individual operators.

By using Pittman-Robinson wildlife funds, the district has constructed about 5½ miles of fence around small areas of eroding gullies to protect sage grouse and reduce erosion. Flocks of sage hen, the vanishing game bird of the West, find protection here and the eroding gullies have an opportunity to become revegetated. The district has assisted landowners in constructing 37 miles of drift fence for the purpose of controlling livestock while on the range.

In connection with water development, Visintainer stated, it became evident more than a year ago that the existing State law concerning the construction of dams was inadequate. It did not provide an inexpensive method of getting water rights for small livestock water dams and was unduly restrictive regarding height of dams.

For these reasons, the district assisted last winter in having a bill presented to the State legislature to make it possible for ranchers to secure a legal right to water stored in small dams for a small fee and with a minimum of red tape. The bill also provided that livestock dams might be built to a height of 15 feet without violating the irrigation-water type reservoir law, thus often reducing the expense of cutting spillways and giving greater water storage, especially in depth.

The legislation was passed, and water development has been facilitated in the Great Divide District. Fifty-eight stock-watering reservoirs, springs, and wells have been developed in the district since its organization.

The president of the District Board of Supervisors is Roy Simon, long-time resident of Moffat County and an active farmer and stockman. Visintainer, the vice president, is a former president of the Colorado Wool Growers Association and former director of the National Livestock Association. Frank C. Estey is secretary-treasurer, and the two remaining members are Henry Prather and J. F. Jacobsen, both of whom homesteaded land in the district about 23 years ago.

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Compiled by ETTA G. ROGERS, Publications Unit

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SCS Wins National Safety Award

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DETROIT

The Southeastern Region of the Soil Conservation Service, headquarters at Spartanburg, has been awarded first place in the National Safety Council's contest for large passenger-car fleets in the eastern United States for the year ended June 30, 1942.

Forty-eight major passenger-car fleets, operated by private concerns as well as State and Federal agencies, took part in the contest.

The Soil Conservation Service operated its cars with an accident frequency of only 0.22 per 100,000 miles of travel. This is equivalent to 450,000 miles of travel per accident or more than a lifetime of driving without accident for the average American motorist.

The Service has a maintenance problem in that its cars and trucks are scattered throughout the region and cannot be serviced and repaired in a centralized shop, such as is maintained by most commercial concerns. This problem was met by negotiating service, inspection and repair contracts with commercial garages and by placing the responsibility for proper maintenance and safe operation on the individual drivers.

Since June 30, as a part of the rubber conservation program, passenger car travel by Service employees has been virtually eliminated. However, the Service is intensifying its safety program in connection with the maintenance and operation of other vehicles.

Richard B. Gossom, Jr., is the SCS regional safety engineer.

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